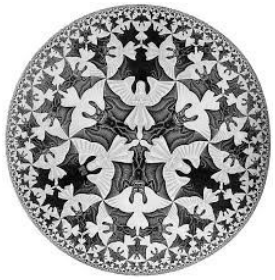
MATH/SCIENCE/COMPUTER SCIENCE MAGNET PROGRAM
Takoma Park Middle School
7611 Piney Branch Road
Silver Spring, Maryland 20910
301-562-5220

June 2023

Dear Magnet Geometry Student,



I hope that you are enjoying your summer vacation. During the weeks that remain, notice that you live in a fabulous world full of mathematics. You will discover geometry in living organisms as well as in works of art and architecture - lines, planes, angles, polygons & polyhedra, circles & spheres. Where do you see geometry around you?

Enclosed you will find a set of summer problems. Please complete this sheet in accordance with the directions and bring your solutions the first day of class. You may discuss the problems with other students. The summer problems are not mandatory, but I strongly encourage you to complete them. They are a great way to sharpen your problem-solving skills, review key algebra topics, and preview concepts in geometry.

It's a good idea to get your supplies ready before school starts. Required materials for Magnet Geometry include a three-ring binder, loose leaf paper, pencils, pens, a ruler, a protractor, and a compass. If you wish to purchase a good quality compass, bring $3.00 the first week of school, and I will have some available. You will also need a calculator with trigonometric functions (sin, cos, tan). If you do not currently have a graphing calculator, you do not need to purchase one for this course; a scientific calculator is fine.

If you have questions before school starts, you are welcome to email me at Sarah_H_Manchester@mcpsmd.org. Come prepared to work hard, think creatively, ask questions, and learn a lot. I look forward to meeting all of you in August. An exciting world of geometry awaits!

Sincerely,

Sarah Manchester

Sarah Manchester
Magnet Geometry Teacher

MAGNET GEOMETRY SUMMER PROBLEMS

If you choose to complete this assignment, please bring your solutions on the first day of school. Please use a pencil (or computer) to neatly record your solutions on **separate paper**. Each solution must include the procedure (steps) you used to solve the problem. You are welcome to discuss these problems and share strategies with others.

You will receive an optional grade based on the **quality** of your solutions.

A. Algebra Review

The problems in this section will help you review some essential algebraic concepts. You may refer to your algebra notes or other resources for guidance. Make sure to show all steps.

1. Simplify each expression using the laws of exponents.

   a. $6x^{10}(5x)^3$ b. $\frac{9y^7(-12y)}{y^4}$ c. $\frac{2}{3}ab^{11}(3ab^4)^2$ d. $\frac{-8rs^5}{-2r^4s}$

2. Simplify each expression using the Distributive Property (including FOIL, if needed).

   a. 15x(x-7) b. $-8x^2(9x^3+0.5x)$ c. (2y+1)(y-8) d. $(3n-5)^2$

3. Solve each equation.

   a. 17-4x = 50 b. 2(⅔k+6) = 18 c. 18x+40 = -4x+50 d. $\frac{5}{7}y - 12 = y$

4. Simplify each expression, putting your answer in simplest radical form.

   a. $\sqrt{28}$ c. $\sqrt{96}$ e. $\sqrt{2} + \sqrt{32}$ g. $\sqrt{12} - \sqrt{75}$

   b. $\sqrt{45}$ d. $\frac{1}{\sqrt{3}}$ f. $\frac{10}{\sqrt{5}}$ (Hint: In d & f, rationalize the denominator.)

5. Solve each quadratic equation by factoring.

   a. $x^2 + 27x + 50 = 0$ b. $x^2 - 24 = 5x$ c. $3y^2 - 17y + 10 = 0$

6. State the quadratic formula, then use it to solve the equation: $2a^2 - 3a = 18$

7. The coordinates of points P and Q are (6, -8) and (-4, 1).

   a. Calculate the length of $\overline{PQ}$. b. Find the midpoint of $\overline{PQ}$.

8. Find the equation of each line using the given information. Put your answer in the form specified.

   a. perpendicular to y = -3x + 1, has an x-intercept of 7 (general form)

   b. contains the point (3, -11), has a y-intercept of 5 (slope-intercept form)

9. Solve each system of equations using the method specified. Express your answer as an ordered pair.

   a. $y = 7x - 1$ (substitution)
      $y = 2x + 9$

   b. $3x + 5y = 10$ (elimination)
      $7x - 15y = 26$

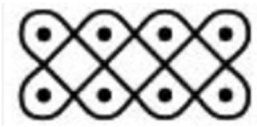
B. Looking Ahead to Geometry

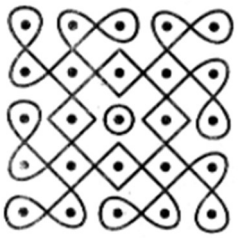
The problems in this section require you to apply concepts and skills (including logic) that will be important in your study of geometry. Show your solutions clearly on **separate paper**.

1. What is the largest number of regions into which you can divide a circle with one line? Two lines? Three lines? Four lines? Draw diagrams, then make a chart showing the maximum number of regions formed when **n** lines intersect a circle, for n = 1…6. Describe a pattern in the chart.

2. Show at least three ways to arrange six congruent toothpicks to obtain four congruent triangles**.**

3. The drawings at right are two examples of Sona patterns. Storytellers of the Chokwe tribe in southwest Africa create these patterns as they recite traditional tales.





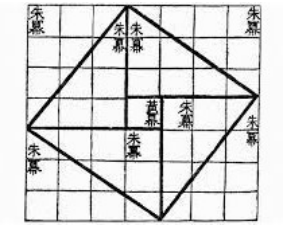
   a. Describe the types of symmetry in each Sona pattern.

   b. Do a little research on the topic and sketch another example of a Sona pattern.

4. From what locations on earth could a man leave his house, then walk three miles north, three miles west, three miles south, and find himself back home, at the same point where he started? (Hint: This is a famous problem; there is one well-known answer, but it is not the only answer.)

5. Draw a regular pentagon and its five diagonals. How many triangles are formed? Show or describe how you counted the triangles. (Hint: Don't forget to count overlapping triangles.)

6a. State the famous theorem relating the sides of a right triangle. Make sure to define any variables used in the equation.



   b. While the Greek mathematician Pythagoras is often given credit for this theorem, other cultures have discovered it as early as, or even before Pythagoras. Do a little research and describe some other civilizations' knowledge of this theorem.

7. When a clock shows the time to be 12:15, how many degrees are in the acute angle between the minute hand and the hour hand?

8. One lollipop at the candy store can be purchased with four coins. To purchase two lollipops requires at least six coins. However, three lollipops can be purchased with only two coins. How much does a lollipop cost? (Coins must be either pennies, nickels, dimes, quarters, or half-dollars.)

9. You have three cans that look identical, other than the labels. One says SODA, one says PUDDING, and one says M&Ms. Your practical joker sister switched the labels so that none of them are on the correct item. You wish to open and drink the soda. You are allowed to pick up one can and shake it (but not touch the others) in order to decide which can has the soda. How should you proceed?

10. The year 1978 has an unusual property. When you add the 19 to the 78, you get 97, the middle two digits of the year. What is the next year that has this property?

11. Geometry Jill baked a rectangular cake for her brothers, John and Jerry. She planned to cut it in half and send an equal amount home with each brother. However, when she took the cake from the fridge, she saw that her son, Geometry Joe, had cut out and eaten a rectangular chunk. How can she make a single straight cut through the cake that will guarantee each brother an equal amount? Jill has string on hand, but no measuring tools. Also, she may not cut the cake parallel to the top surface. Each brother should receive an equal amount of the frosted top.